

- V. "On the Mathematical Expression of Observations of Complex Periodical Phenomena, and on Planetary Influence on the Earth's Magnetism." By CHARLES CHAMBERS, F.R.S., and F. CHAMBERS. Received May 26, 1873.

(Abstract.)

The authors propose in this paper to determine, by Bessel's method, a mathematical expression for a periodical phenomenon from observations which are affected by one or more other periodical phenomena, and to find criteria for judging of the extent to which the expression is affected by these other phenomena: to find also the true period from observations of a single periodical phenomenon of which the period is only approximately known; or, having found an expression for a period of known approximation to the truth, to find from it the expression for the true period. In the course of these inquiries, certain ambiguities which affect similarly Bessel's expression for a single periodic phenomenon and the results here arrived at are remarked upon; and, finally, the results are applied to determine the nature of periodic planetary phenomena in a particular case.

- VI. "The Diurnal Variations of the Wind and Barometric Pressure at Bombay." By F. CHAMBERS. Communicated by CHARLES CHAMBERS, F.R.S., Director of the Colaba Observatory, Bombay. Received May 26, 1873.

(Abstract.)

The object of this paper is to bring to notice a remarkable relation that has been found to exist between the diurnal variations of the wind and the barometer at Bombay.

The observations made use of are the records of a Robinson's anemograph during the first three years of its performance, viz. from June 1867 to May 1870, and the corresponding hourly observations of the barometer and the dry- and wet-bulb thermometer made at the Government Observatory, Bombay.

The mean results for each hour of the day during the whole period and the mean diurnal variations of each element are tabulated and graphically represented by figures. The diurnal variation of the wind is then investigated, the most influential part of which is attributed to the land- and sea-breezes which blow from E.S.E. and W.N.W., and are shown to follow mainly the same law of progression as the temperature of the air, thus affording confirmatory evidence of the truth of Halley's theory of the trade-winds as applied to land- and sea-breezes.

Some peculiarities of the curve representing the land- and sea-breezes are then pointed out, and these, the writer concludes, are due to the super-

position of another distinct variation having two maxima and two minima in the twenty-four hours, like the barometer variation ; and he supports his views by a reference to the variation of the east components of the wind in the months of July and August, when the land- and sea-breezes have almost disappeared. This is found to exhibit a decided *double* period. The north components of the land- and sea-breezes are then approximately eliminated from the north components of the whole variation, and the variation which then remains exhibits a very decided *double* period in this direction also. These variations with double periods are regarded as indicative of the existence of a double diurnal variation in the general movements of the atmosphere. Upon this hypothesis typical diurnal variations of the wind are deduced for north and south low latitudes—that for north latitudes exhibiting a double diurnal right-handed rotation, and that for south latitudes a double diurnal left-handed rotation ; and from these the diurnal variation of the barometer is deduced.

The movements of the wind-vane at Bombay are then analyzed ; and the writer concludes that the greater part of the excess of “ direct ” over “ retrograde ” rotation of the vane at Bombay is due to the *diurnal variation* of the wind.

Extracts are given from observations made at St. Helena, Toronto, and Falmouth, showing the character of the diurnal wind-variations at those places, and their greater or less agreement with the deduced typical curves. The writer maintains that these variations afford independently a possible, if not a probable, explanation of that movement of the air which Dové had called the “ Law of Gyration ; ” and, in conclusion, he points to the extent of their applicability in deducing weather probabilities, and to the method of discussing storms.

A postscript is added, giving the mean diurnal variation of the wind at Sandwich Manse, Orkney, and pointing out its general conformity with the results deduced from the Bombay wind-observations.

VII. “ Researches in the Dynamics of a Rigid Body by the aid of the Theory of Screws.” By ROBERT STAWELL BALL, LL.D.  
Communicated by Professor CAYLEY. Received May 29, 1873.

(Abstract.)

This paper contains some developments of a theory sketched in the Transactions of the Royal Irish Academy, vol. xxv. p. 157.

PART I. discusses the quantity of energy necessary to give a body a twist about one screw while acted upon by a wrench about another screw. The expression *virtual coefficient* is defined, and application is made of the reciprocal character of the virtual coefficient to solve the problem of resolving a wrench along six given screws.